Impact of lactic acid solutions on chicken skin surfaces decontamination

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Abstract

Poultry carcasses are often contaminated with foodborne pathogens, including *Salmonella spp*., *Campylobacter jejuni*, and *Listeria monocytogenes*, the highest contamination being found on the skin. In addition to the improvement in the husbandry and slaughtering practices, mild decontaminating treatments could be applied to increase the safety and the shelf life of poultry products. Thus, the objective of this study was to evaluate the decontaminating effect of lactic acid (LA) on chicken skin inoculated with *Listeria innocua*, used as a model of pathogenic bacteria.

Keywords

Decontamination, poultry, lactic acid, *Listeria innocua*

Material and methods

A strain of *Listeria innocua* (CLIP 20-595) was incubated in nutrient broth for 24h to achieve stationary phase population. The culture was then centrifuged at 5000 g for 20 min at 20°C. The resulting pellet was diluted in sterile physiological water. The final concentration of the so obtained inoculum was 10^8 CFU/ml.
Chicken thigh skins, purchased in a local store, were used. An inoculation/decontamination device was developed, which allowed the inoculation of a 7cm^2 surface of the skin for 2 hours at 20°C. The skin was then thoroughly rinsed six times with 25 ml of sterile physiological water, to eliminate non-adhering bacterial cells.
The inoculated skin was then treated with lactic acid (LA) solutions (VWR International). Skin analyzes were done either immediately after treatment, or after a 7-day storage period at 4°C in filmed Petri dishes. Remaining bacteria were recovered by pummeling the skin for 5 min in 25 ml of buffered peptone water (Biokar diagnostics). Serial dilutions were made in sterile physiological water and plated twice on OXFORD agar plates. The detection limit was 2.5 log cfu/cm^2.

Two sets of experiments were carried out:
1 – LA concentration fixed at 2% (v/v), treatment time: 0 (control), 0.5, 1, 10 and 30 minutes.
2 – Treatment time: fixed at 1 minute, LA concentration: 0 (control), 0.5, 1, 2, 5 and 10% v/v.
Three replicates were done for each experiment.

Results and discussion

The results of each set of experiments are summarized in Figure 1 and Figure 2.
Figure 1 represents the concentration of *Listeria innocua* on chicken skin after a 2% LA treatment for several treatment times. Immediately after treatment, no significant effect of the treatment could be observed. After a 7-day storage period, a significant bacteriostatic effect

was observed, even for short treatment times (0.5 minutes). The *Listeria innocua* concentration on the treated skin was 1.1 to 1.9 log lower than that on untreated control, for 30 s and 30 minute treatment times with a 2% LA solution.

Figure 2 represents the concentration of *Listeria innocua* on chicken skin after a 1 min treatment with several LA concentrations. Immediately after treatment, an effective decontamination could be observed for LA solutions of at least 5%, with bacterial concentrations reductions of 0.7 and 1.2 log for a 5% and 10% LA treatment respectively. After a 7-day storage period, a significant bacteriostatic effect could be observed for 2% LA. Bacterial counts were similar after a 7-day storage period and immediately after treatment. For the 10% LA treatment, further decontamination occurred during the storage period: bacterial counts were lower after a 7-day storage than immediately after treatment. The *Listeria innocua* concentration on the treated skin with a 10% LA solution for 1 min was more than 4.4 log lower than that on untreated control. In two out of three replicates of this latter LA treatment, bacterial concentrations were lower than the detection limit.

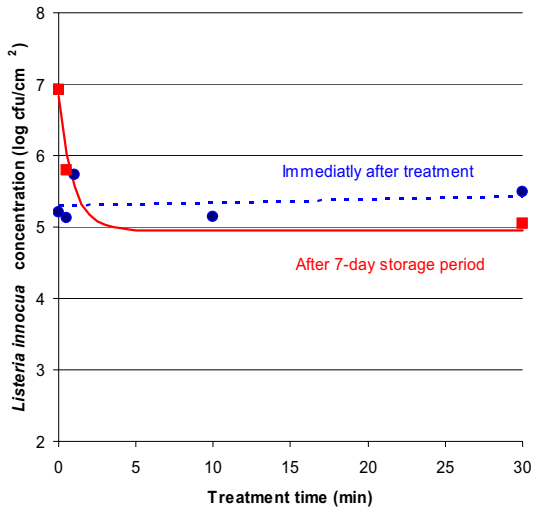

Fig 1 : Populations of Listeria innocua on inoculated chicken skin treated with 2% v/v lactic acid solution, immediately after treatment (circles, dotted line) or after a 7-day storage period at 4°C (squares, solid line)

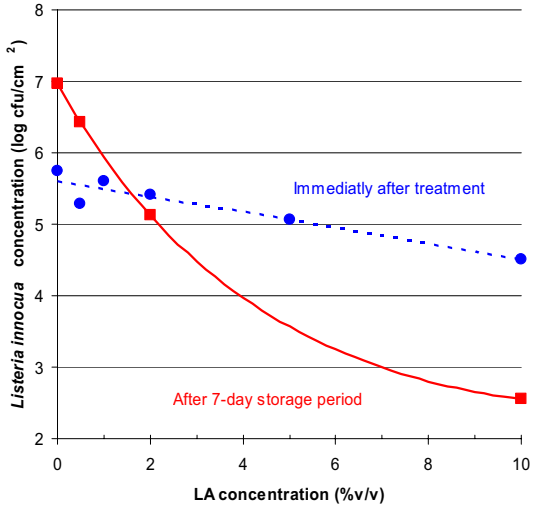

Fig 2 : Populations of Listeria innocua on inoculated chicken skin treated for 1 min with several lactic acid solutions, immediately after treatment (circles, dotted line) or after a 7-day storage period at 4°C (squares, solid line)

High lactic acid concentrations provided a significant decontamination of chicken skin. Furthermore, a residual bacteriostatic effect was observed even with low LA concentrations. These results showed that using lactic acid under the specified experimental conditions could increase both the shelf life and the safety of the poultry products.

Acknowledgments

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